QDS Intelligent soft starter

Product manual

Please read the product manual
in detail before using the product.

QDS Intelligent Soft Starter

Operation Manual

Shanghai Qirod Electric Science &Technology Co.,Ltd

Pre-word

Thank you for choosing “QDS”series motor soft starter manufactured by Qirod. This product is available for the soft starting and stops of three-phase squirrel cage motor. Please read and understand the contents in this manual before use in order to apply correctly.

Safety notice item
▪ **Please read this manual careful so as to realize the optimized performace.Changing or setting parameters will have influence on the functions and performance, So parameters of soft starter should be changed by qualified (Professional) person in order to avoid problems. Only qualified (Professional) technicians are allowed to install QDS soft starter.** ▪ **Please guarantee the power of motor and QDS soft starter is fitting. Installation must be carried out according to user manual rules.** ▪ **don’t connect the capacitor at the end of soft starter output, or else the soft starter will be damaged.** ▪ **Input and output copper wire lug of QDS series soft starter should be packed with insulated rubber tape after installation** ▪ **Keyboard control should be locked when remote control is enabled** ▪ **The enclosure of soft starter should be grounded firmly.** ▪ **Input power supply should be cut off while carrying out maintenance.**

In spite of writing down this manual carefully, but Qirod can’t guarantee this manual without tiny mistake. The product described in this manual is subjected to change regarding the technology and operation methods without notice. Please understand that this point won’t be taken in consideration in contract.

Contents

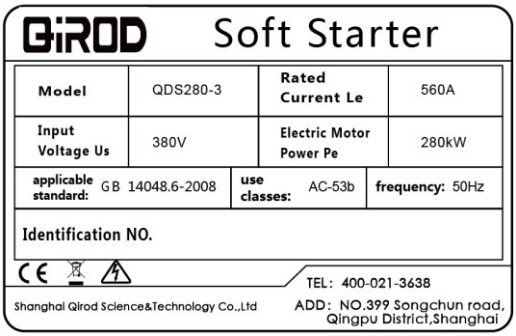
1 Check related items before use

1-1 Good arrival check

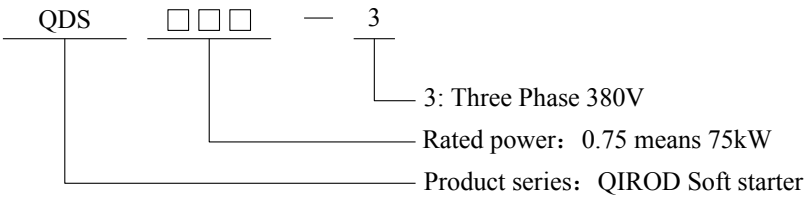
After receiving the product you order, Please open the box and check all items below, if some product problems exist or product is not in accordance with your type. Please contact with the distributor or nearest office of QIROD.

①Inspect the nameplate on the soft starter to confirm the model you ordered.

Type nameplate



Soft starter type

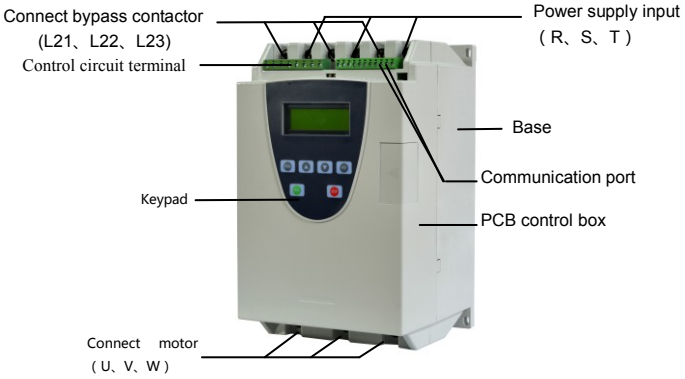


① Check if there is any damage of appearance during transportation, such as cover and bending of enclosure, damage or drop of components.

② In addition to soft starter as well as including a operation manual and quality certificate.

③ Please lift the enclosure when you remove soft starter, not lift the PCB board cover, or else possibly cause damage of drop or human injury.

1-2 Product appearance



2 Installation and connection

2-1 Application environment

Table 2-1-1means installation environment requirements

standard	Conform to national standard（GB14048.6-2008）
Three phase voltage	380V±15%
Frequency	50Hz
Available motor	three phase squirrel cage motor
No. of Starting	Defined by load, no more than 6 times/h is suggested
Vibration	15g11ms
Anti-earthquake	Altitude below 3000m,vibration device below 0.5G
Environment temperature, working temperature	0-+40℃ without derating,between +40℃-60℃ ,current decreases by 1.2% while temperature rises 1℃
Stock temperature	-25℃-70℃
Environment humidity	95% non-condensing or water drop
Maximum working altitude	below 1000m without derating,above 1000m,current decreases by 0.5% while altitude rises 100m
Cooling method	Natural cooling
Maximum working angle relative to vertical installation	No requirement

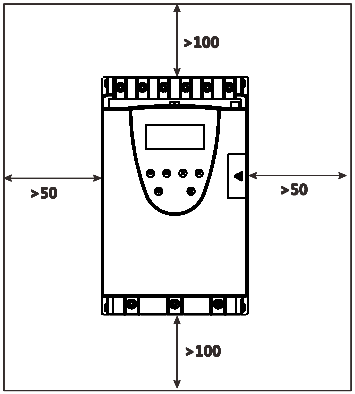
2-2 Installation requirements

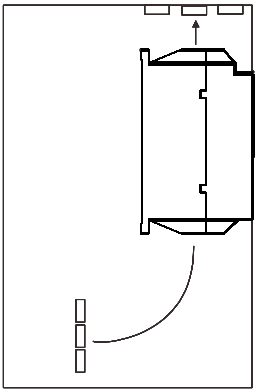
① Soft starter should be installed vertically,reversed,angle or horizontal installation are not allowed. The screws should be used to make soft starter fix on the firm structure.

② Soft starter will generate heating while runs, in order to make air pass, as shown in 2-2-1, specified space should be left.

③ The heating will rise up, so soft starter is not allowed to install under the device which is not withstanding the heat.

2-2-1





2-3 Connection

Please pay attention on each instruction below while wiring:

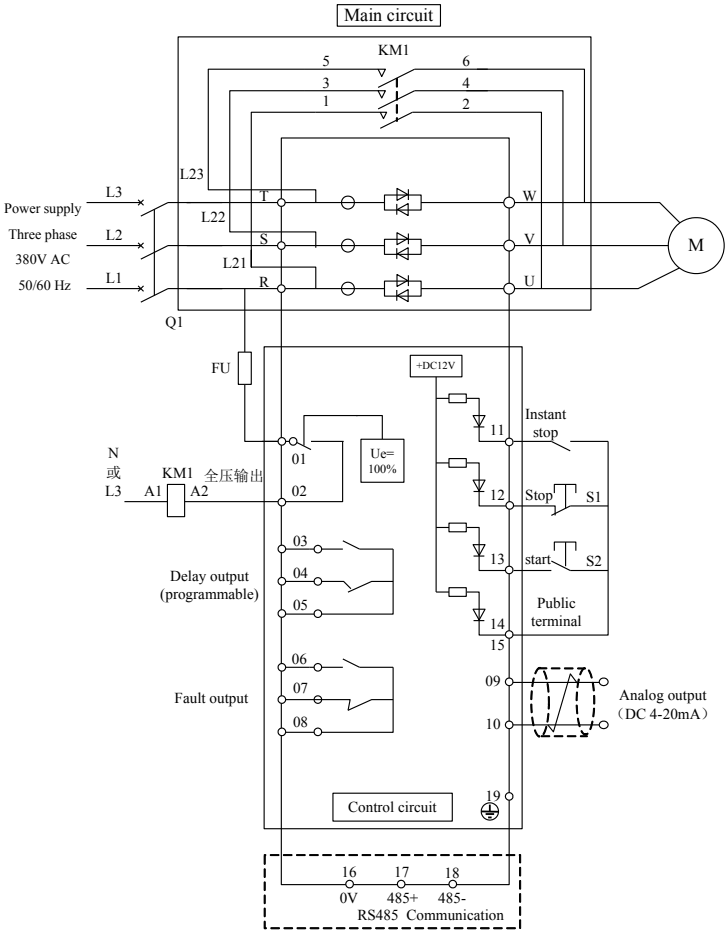
① Main power has to connect with power terminal R、S、T, no phase sequence requirement. If the power is wiring wrong, the soft starter will be damaged.

② Earthling terminal must be earthed well, on the one hand protecting electric shock or fire accident, on the other hand reducing noise.

④ Two ends of conductor should be dealt with crimping in order to guarantee reliability of connection.

2-3-1 Basic wiring

2-3-1



2-4 Main power and earthling terminal connection

Table 2-4-1 Main power and earthling terminal function

Terminal mark	Terminal name	Instruction
R、S、T	Main power input	Connect with three phase power
U、V、W	Soft starter output	Connect with motor
L21、L22、L23	Bypass connection	Connect with bypass contactor
⏚ PE	Soft starter earthling	The enclosure of soft starter should be earthed well

(1) Main power input terminal （R、S、T）

①Main power input terminal R、S、T should be connected through circuit breaker or circuit breaker with earth leakage protection to three-phase AC power without consideration of the phase sequence.

②Controlling the running and stopping of soft starter through main power ON/OFF is not allowed, please wait for power on of soft starter then select control terminal or RUN or STOP key on panel to make soft starter start and stop.

③Don't connect with single-phase power.

（2）Soft starter output terminal （U、V、W）

① Soft starter output terminal should be connected with three-phase motor according to correct phase sequence. If the rotation direction is not correct, just exchange any two phases connection of U、V、W.

② Soft starter output should not connect with capacitor and surging absorber.

③ When the cable between soft starter and motor is long, the distributed capacitor will generate major HF current which will cause over current trip of soft starter, current leakage increasing and bad current display presion.So the suggested connection length is not above 50m,

（3） Bypass connection（L21、L22、L23）

① Bypass connection terminal L21、L22、L23, should be connected with bypass contactor, or else soft starter will be damaged. When soft starter finishes starting, main power components (SCR) will be bypassed, meanwhile, bypass contactor will work, so motor will run normally, Please make sure the correct phase sequence.

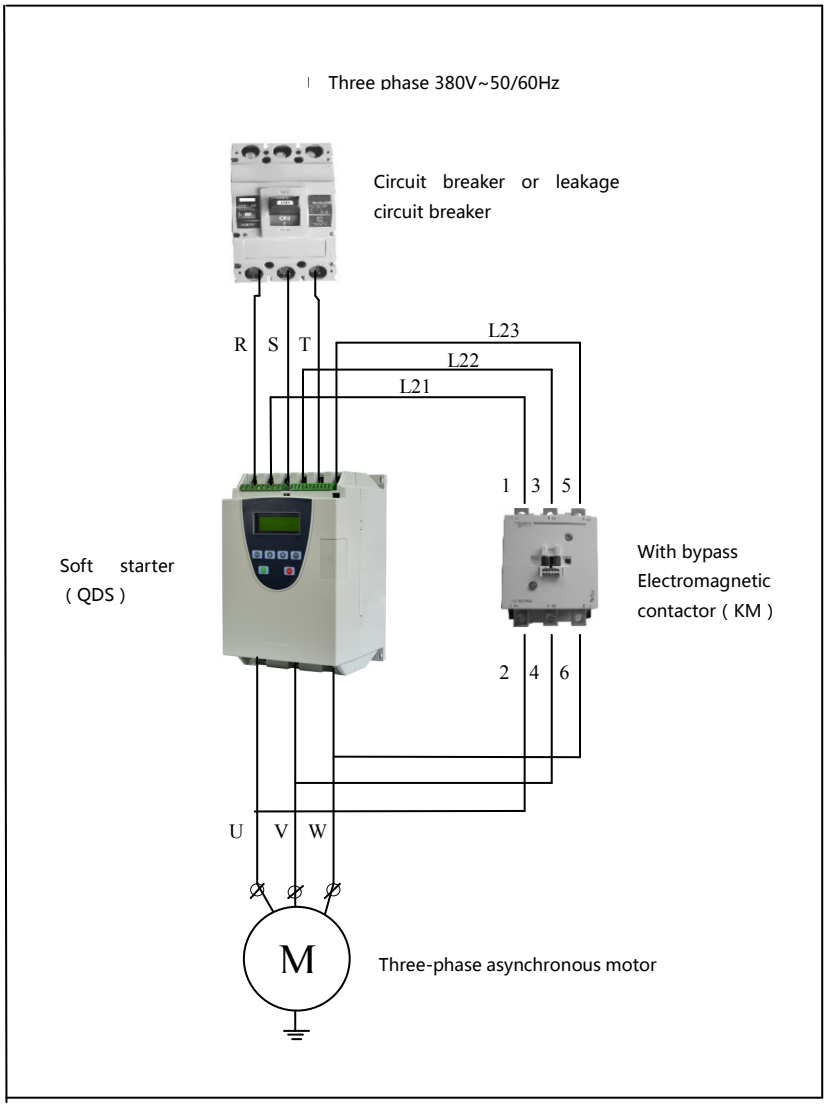
（4）Soft starter earthling terminal（ ⏚ PE）

① In order to guarantee safety and reduce noise, soft starter earthling terminal should be earthed well. in order to prevent electric shock and fire accident, metal enclosure and frame of eclectic device should be in accordance with national electric rule requirements.

 Danger	Make sure that the input phase No. and rated input voltage of soft starter are conforming to AC power supply phase No. and voltage. AC power supply can't connect to output terminal （U、V、W）. Bypass contactor should be connected and also the phase

	sequence is same with main power, or else possible damage accident will be caused.

2-5 soft starter main circuit connection



2-6 Control terminal connection

Control terminal function table 2-6-1. According to different function setting, control terminal function and wiring will be different.

Terminal name	Terminal mask	Function instruction
Bypass output	01、02	01,02 are closed to control bypass contactor after soft starting finishing 
Running output（delay）	03、04、05	03、04、05 are programmable relay outputs, delay time will be set by code F4. Output function will be set by code FE,they are NO/NC ,they will close when output is valid,(NO capacity is 250V/5A, NC capacity is 250V/3A)
Fault output	06、07、08	06、07、08 are programmable fault relay outputs, they will be closed when faults occur or power off and be open when power on.(contact capacity 250V/3A)
Analog output	09、10	09、10 can measure current information which fluctuates with load. Output 4-20mA, calibration value 400%, calculation formula: D=400/16(Ix-4). Ix is the actual measured value (mA), D is motor current (%)
Instant stop input	11	11 and common disconnecting will make motor stop immediately.(or free stop)
Soft stop input	12	12 and common disconnecting will make motor soft stop.(or free stop)
Starting input	13	13 and common closing will make motor running.
common	14、15	Common terminal of input signal
communication	16、17、18	Communication terminal which is used to connect lot of motor, 16 is communication earthling.
PE	19	earthling terminal

（1）Input terminal

① When the external control terminals are used for the function of start and stop, please enable code FB as external control

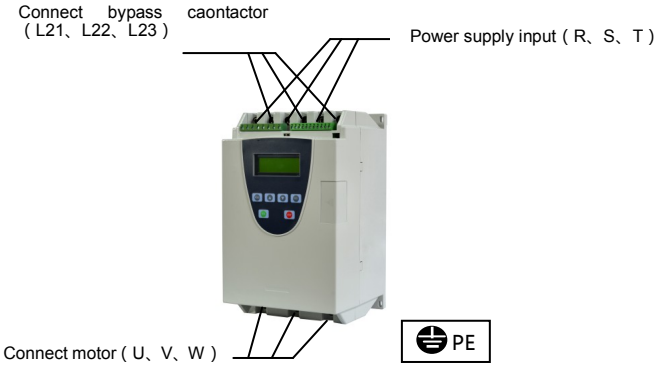
② If remote control is needed, suggest using (two lines) control mode, see P8: 2-9(two lines control mode)

③ Input terminal and common terminal of connection signal are generally closed/open (ON/OFF), soft starter, motor and wiring will cause interference. So the wiring should be a bit short (below 20m). The shielded cable should be applied.

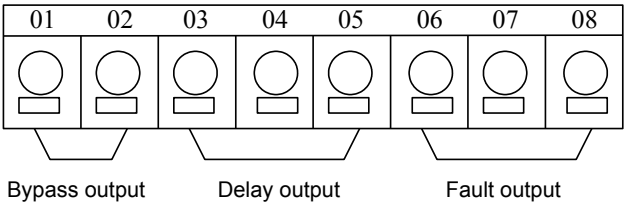
④ The wiring of control terminal must keep away from main power cable, or else possibly cause misacting because of interference.

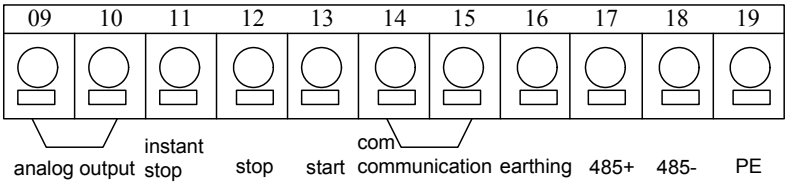
2-7 Terminal layout diagram

（1）Main circuit terminal diagram



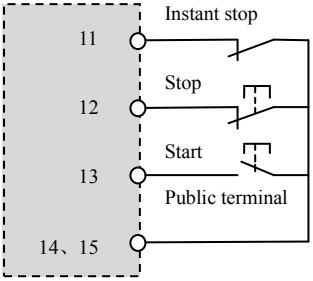
（2）Control circuit terminal



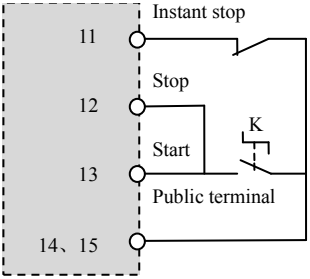


（3）control circuit wiring

Three lines control mode



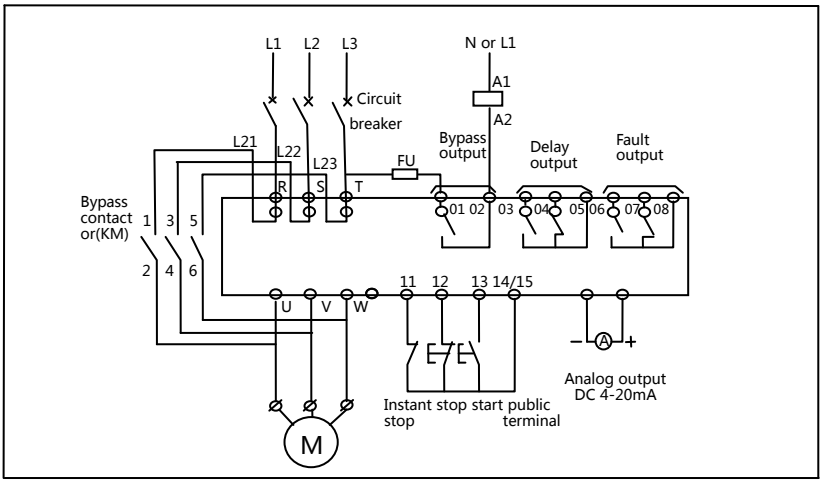
two lines control mode



Control terminal cable 0.75-1.25mm2

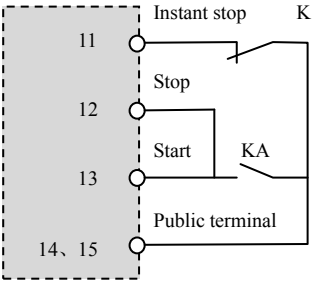
It is under running when K is closed. And it stops when K is open.

2-8 Primary and secondary wiring diagram

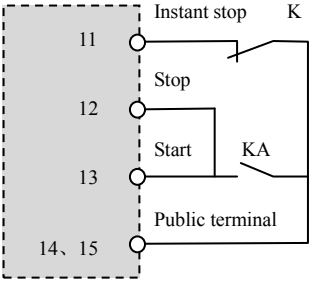


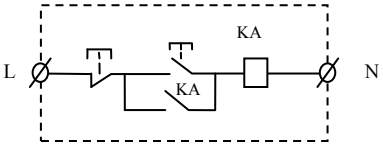
2-9 Relay and remote control wiring

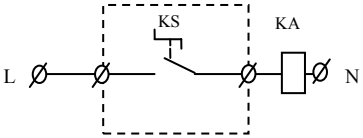
Diagram Relay control mode



Remote control mode







K is the often-closed point of other protects equipment like heat protector. Ex-factory is short connected.

3 Running

3-1 Check preparation before running

Check preparation before running

① Check if the wiring is correct, especially check that output terminals should not connect with power, check if bypass contactor is connected well and make sure that earthling terminal is earthed well.

② Make sure that terminals or nude live part is not short-circuit or short-circuit to earth.

③ After power switches on, keyboard panel will display Ready, meanwhile ready lamp will be lighting.

3-2 Running method

- Swathing on will display (Ready), and the ready indication lamp turns on, then pressing the key will start the motor.
- Input the rated current into parameter code FP according to motor nameplate.

- Check if the motor rotation direction is correct and running is normal after starting, if the running is abnormal, pressing stop key to stop or cutting off main power if necessary.
- If the starting state of motor is not reasonable, please refer to P19 and P23 the chapter of starting mode and application of soft starter for selecting adequate mode.
- Starting voltage code F0(voltage ramp mode)or current limitation code F5(current limitation mode), elevate starting torque of motor.
- After switching on soft starter, don't open the upper cover for fear of electric shocks.
- Within commissioning, any abnormal phenomenon, such as abnormal noise, smoking or odor occurs, power supply should be cut off immediately and verify the reason.
- After power on or starting, the fault indication lamp lights and HMI displays Errxx, please Refer to P17 table to find the reason according to the fault code.
- Pressing stop key or remote stop button can reset the fault state.

Note: when environment temperature is lower than -10°C, Please pre-heat after power on for more than 30min before starting

4 Keyboard panel

Keyboard panel has abundant operation function, such as keyboard panel start and stop, data confirmation and modification and also sorts of state confirmation functions

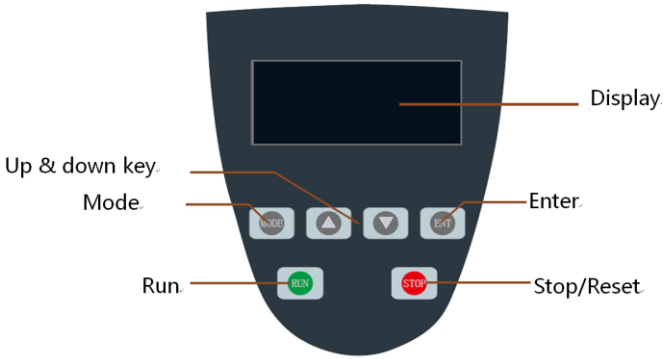


Table 4-1-1 Operation key function

Key name	Main function
Run key	Display READY, press this key for starting, and meanwhile display starting state.
Stop key	1、Display A000(current value) for normal running, press this key for stopping. Display -0000 when soft stop. 2、This key can reset the fault state.
Setup key	Indicate ready statusREADY. Press tjos key to enter into the menu and pre ss the key again when it displays F0:30. When the colon is flashing, then we can modify the parameter with up or down key.
Mode key	1、After modifying the parameters, pressing this key to store, displaying GOOD and sounding twice mean the data have been stored well, press this key again or stop key will exit. 2、Pressing this key will display power voltage.AC380 refer to:P14: 8-1 3、Keeping Pressing mode key will make setting parameters recover to factory value.
Up and down key	1、 Entering the menu setting and using up and down key to modify parameters,(when colon is not flashing, xx:xxx this key can be used to modify function code. when colon is flashing, xx:xxx this key can be used to modify data code) 2、During running, this key can be used to monitor running A current, P(power),H thermal balance display of overload

- When figure > ‘999’, the last digit will delight to mean that the last digit will add ‘0’.
- Soft starter will have warning sound when Pressing key, or else this key is invalid.
- The keyboard can be connected with external control panel,(installed outside of the cabinet) connection wire distance is less than 3m.

5 Basic function

5-1 Code function setting

●Parameters setting code listed in following table

Code function setting				
Code	Name	Set scope	Factory value	Instruction

F0	Initial voltage	30-80%	30%	Valid for Voltage ramp mode: initial voltage of current mode is 40%
F1	Starting time	2-60S	16S	Invalid for current limitation mode
F2	Soft stop time	0-60S	0S	Setting 0 is free stop. If one driving two mode, please set as 0.
F3	Starting delay	0-999S	0S	Using countdown mode to delay, setting 0 will not delay and start immediately.
F4	Programmable delay	0-999S	0S	Using for programmable relay output
F5	Starting current limitation	50-500%	280%	Valid for current limitation mode: the maximum current limitation is 400% for voltage ramp mode
F6	Maximum working current	50-200%	100%	This is the percent of rated current
F7	Under voltage protection	40-90%	80%	Protection will activate less than setting value
F8	Overvoltage protection	100-140%	120%	Protection will activate more than setting value
F9	Starting mode	0-5	1	0 current limitation,1 voltage 2 kick 0ff+current limitation, 3 kick off +voltage,4 current ramp,5 dual closed-loop
FA	Output protection enable	0-4	4	0 Primary1 light load 2 standard 3 heavy load 4 advanced
FB	Control mode	0-6	1	0 keyboard; 1 keyboard external control; 2 external control ;3 external control +communication; 4 keyboard external control +communication ;5 keyboard +communication; 6 communication
FC	Parameter Modification allowed	0-2	1	See in detail P12
FD	Communication address	0-63	0	Used to communicate between multiple soft starters with upper machine.
FE	Programmable output	0-19	7	Running relay output(03,04 terminal) setting
FF	Current limitation of soft stop	20-100%	80%	Detailed instruction P21
FP	Motor rated current	1-99S	Rated value	Used to input the rated current of motor

FU	Bypass switching time	0-3	3	
FL	Three-phase imbalance protection enable		3	0 imbalance disenable, phase loss disenable; 1 imbalance disenable, phase loss enable; 2 imbalance enable, phase loss disenable; 3 imbalance enable, phase loss enable

Note：1 Parameter F6 maximum working current means the maximum continual running current calculated base on parameter FP, if the maximum running current exceeds this value. The reverse time limit thermal protection will be activated.

2 Staying setting state more than 2 mins without any pressing operation, display will automatically exit from setting state.

3 Within soft start and soft stop period, No parameters can be set, for other state all the parameters can be set.

4 Keeping pressing confirmed key (YES) after power on will make setting parameters (excepting for FE) recover to factory value.

6 Detailed instruction of functions

6-1 Code FE is used to set when the running output delay will activate.

Programmable relay output will have two types work mode, namely programmable time Sequence output and programmable state output.

（1）When Setting FE 0~4(10~14), programmable output works under time sequence output, setting starting moment of output.

Shown as following table

FE Setting value	0（10）	1（11）	2 （12）	3（13）	4（14）
Programmable output moment	When run command is given	When it is starting	When bypass is closed	When stop command is given	When stop is finished

- This working mode includes a 999 seconds timer, set by F4, if F4 is not 0, the timer will count according to the initial time set in FE. When the time is reached, the output will change the state.
- The reset time of this output will be in accordance with the time set in F4, delay ending and staying in ready state for 1 second.

- Programmable time sequence output mode uses a starting process as control period, if the motor restarts ,the previous programmable output process will be automatically interrupted and programmable output process will be started again.

（2）Code FE=5~9, programmable output will be set as start output mode, the setting working state is shown in following table.

FE setting value	5 （15）	6（16）	7（17）	8（18）	9（19）
Programmable output moment	Fault output	Running state	Ready state	Starting state	Stop state

- The programmable output will be used to indicate the working state of soft starter, FE=7 is factory value. which means that soft starter stays in ready state, for this state, soft starter is ready to start motor; when the programmable output is fault state which means motor fault（Err05、Err06、Err07、Err08、Err012、Err15）,it is different from the function of fault terminal ⑤、⑥. Running state is neither ready state nor fault state, which includes start, bypass and soft stop.
- When FE>9, reset state of the programmable output(③、④ external connection terminal) will switch from NO to NC. Namely reversed direction output. The flexible application of programmable output function can simplify peripheral logic control circuit.

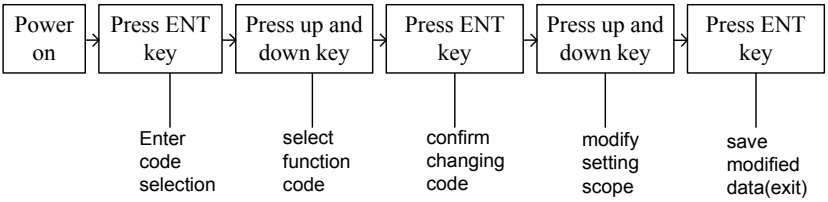
6-2 Code FC parameters modification enable function.

Parameters modification enable has three modes:

- FC=0, except for FC, prohibited to modify any parameters
- FC=1, prohibited to modify values of F4、F6、Fd、FE、FF、FU、FL.
- FC=2, allowed to modify all the values of parameters

7 Operation process

7-1 Modify setting parameters



For example :(operation control mode is external terminal, namely code FB=2)

No.	Operation	display	Instruction
1	Power on	READY	QDS technology or ready state
2	Press ENT	F0:30	Enter function code selection state
3	Press up and down key	Fb:01	Enter code FB (operation control mode) function selection state.
4	Press ENT	Fb:01	Colon is flashing, means that the setting scope can be changed
5	Press up and down key	Fb:02	Means external terminal control
6	Press ENT	GOOD	Save modified data(exit)

Soft starter interior buzzer will sound when the keyboard is operated.

8 Help information

8-1 help information and Instruction

Help information will notice as following table

Display	Instruction
AC：XXX	3 bits digital voltage meter, used for monitoring three-phase AC power voltage.
055-3	Notice that the type of this soft starter is 55kw-380/50Hz
H1：E05	Notice latest happened fault information Err05
H2：E01	Notice ever happened fault information Err10
H3：E06	Notice ever happened fault information Err06
....	.....
H9：E00	Notice no fault information
UEr3.0	Notice the software of this product is Ver3.0
LXXX	Total Successful No. of starting
RUNXX	Previous soft starting time(no matter Succeed or not)
Recursive mode will be used for H1~H9 to store latest 9 fault messages.	

- When they are not soft starting/soft stop state and not enter setting state, entering help information is allowed, press ENT key and press up and down key to refer to notice information.
- Under help state, pressing ENT key or stop key to exit help state.

9 Protection function

9-1 Protection function instruction

QDS series soft starter has complete protection functions which will protect application safari of soft starter and motor. For the detailed application, protection class and protection parameters should be set correctly according to different application.

- Soft starter overheat protection: The protection will activate when temperature rises to 80℃±5℃.when the temperature decreases to 55℃ (lowest), overheat protection will relieve.
- Input phase loss protection delay time: <3s
- Output phase loss protection delay time:<3s
- Three phase imbalance protection delay time:<3s.the deviation of each phase current more than 50%±10% will be set as benchmark. when the load current is 30% lower than the rated current of soft starter. The standard of criterion deviation will increase.
- Starting over current protection time: Protection time table P15:9-2-1for continually more than 5 multiples of code F5 (maximum working current) w
- Running overload protection time: Code F5 (maximum working current) will be set as the benchmark of anti-time thermal protection. Trip protection time curve (see 9-3-1)
- Over low of power supply protection delay time: When the voltage of power is lower than limited value 40%, protection action time <0.5s, or else less than the setting value, the protection action time<3s.
- Over high of power supply protection delay time: When the voltage of power is higher than limited value 130%, protection action time <0.5s, or else more than the setting value, the protection action time<3s.
- Load short-circuit protection delay time<0.1s, current is more than 10 multiples of the rated current of soft starter. This protection can't replace the fuse or short-circuit protection device.
- The time parameter above means from detecting the effective signal to send out trip protection command, Time parameters are just for reference. If the protection functions of soft starter can't comply with the user's requirements, so the specified protection device is demanded i9n order to make sure the safety

9-2 Protection functions setting

In order to adapt to different applications, soft starter has 5 protection class, namely 0: primary 1: light load 2: standard 3: heavy load 4: advanced, all are set by Code FA.

- Primary protection prohibits the function of external emergency stop terminal, at same time, reserving overheat, short-circuit and input phase loss protection of starting, which is available for emergency starting without considering any conditions. Such as fire pump.
- Light, standard and heavy load have complete protection function, the deference is that the overload thermal curves of motor are different. The motor thermal protection time parameters can refer to 9-2-1 and 9-3-1.
- The advanced protection will follow more strict starting protection standard. Other protection functions parameters are same with standard protection setting

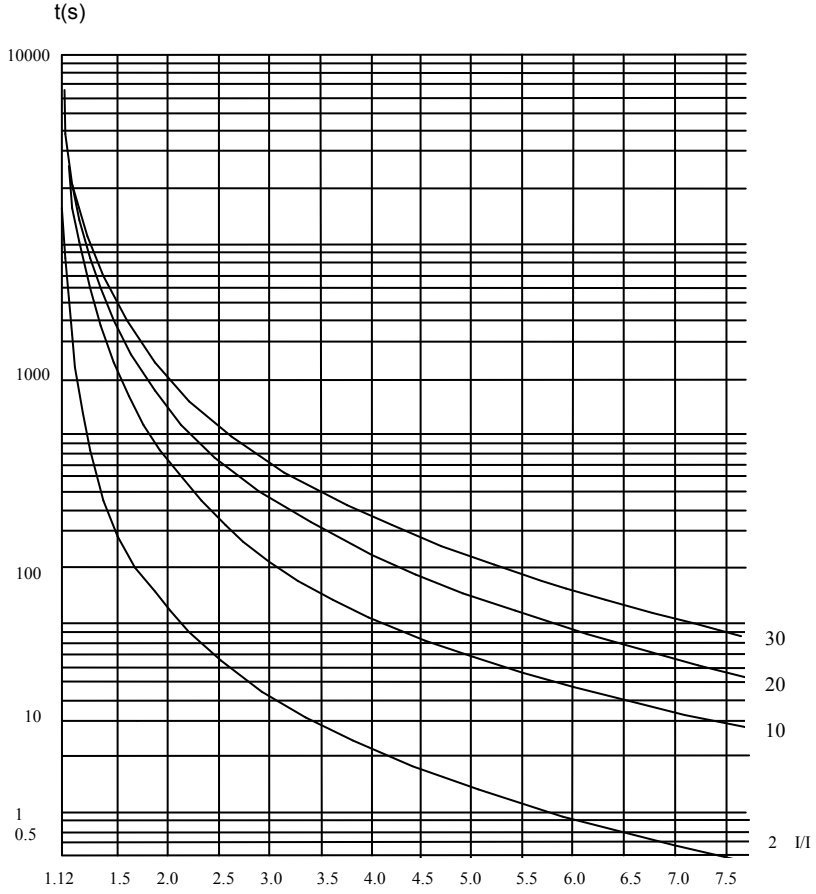
Code FA setups different protection level and heat protection time. Please see the form 9-2-1 to setup of

Code FA setting		0 (primary)			1 (light load)			2 (standard)			3 (heavy load)			4 (advanced)			Instruction
Running overload protection class		No			2 class			10 class			20 class			10 class			comply with IEC60947-4-2 standard
Running over current protection class		No			3 class			15 class			30 class			15 class			Calculated base on 5 multiples of Starting current
Running overload trip time table	Current times (I/Ie)	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	Value in table is typical value.
	Trip time (sec)	4.5	2.3	1.5	23	12	7.5	46	23	15	4.5	23	1.5	23	12	7.5	

- Please set code FP according to rated current on motor name plate or else , the starting current and protection current will exist big deviation.
- Motor current set in Code FP can't be less than 20% of rated current of soft starter. When motor current set in Code FP is a little bit small, the sensitivity error of protection trip action will increase.

9-3 Protection trip curves

The motor thermal trip time curves complying with IEC60947-4-2 standard are as following. 9-3-1



Motor thermal trip time curves (thermal state)

10 Protection action

10-1 Protection action list

When soft starter is abnormal, the protection action will be active and trip immediately. Alarm name displayed in LCD and related contents can refer to instruction in table 10-1-1.

Table 10-1-1

display	instruction	Problem and treatment measures instruction
Err00	fault release	Under voltage, overvoltage or overheat and open circuit of emergency terminal faults are emerging just now, now is normal, Ready lamp is lighting, after reset, soft starter can be used to start motor.
Err01	Open circuit of external emergency stop terminal	Connect external stop terminal 7 and common terminal 10 or connect to other NO contact of protection device
Err02	Overheat of soft starter	Start over frequently or motor power and soft starter power are not matched
Err03	Starting time is more than 60sec	Starting parameters setting is not suitable or the load is too heavy, power capacities is not enough and so on.
Err04	Input phase loss	Check if existing input or main circuit fault, if bypass contactor is blocked and keeps at close position and id SCR is open circuit.
Err05	Output phase failure	Check if existing input or main circuit fault, if bypass contactor is blocked and keeps at close position and id SCR is open circuit.
Err06	Three phase imbalance	Check if input three phase power supply and load motor are normal
Err07	Starting over current	If load is over heavy or motor power and soft starter power are not matched
Err08	Running overload protection	If load is over heavy or code F6 and FP parameters setting are not suitable.
Err09	Overflow of power supply	Check if input power supply voltage is low or parameter F7 setting is not suitable
Err10	Over high of power supply	Check if input power supply voltage is low or parameter F8 setting is not suitable
Err11	Setting parameter error	Modify setting or holding Enter key for power on to recover the factory value

Err112	load short-circuit	Check if load or SCR is short-circuit or load is over heavy
Err13	Automatic restart wiring error	Check if external control terminal and stop terminal are not connected according to 2 wires mode
Err14	Automatic stop wiring error	When external control mode is allowed, external stop terminal is open circuit, so the motor can't start.
Note: some faults are interconnected, such as displaying Err02 soft starter overheats which may be caused by starting over current or load short-circuits. So when checking the fault, reasons should be considered completely so as to judge the fault point precisely.		

Attention: when motor is starting successfully by using soft starter, the running state indication lamp in the panel will be lighting, that means bypass contactor is close, when motor stops because of the open of bypass contactor, bypass contactor and related wiring should be checked in order to make sure not mistake or misconduct.

11 Fault diagnostic

11-1 Problems and measures

Abnormal phenomenon	Checking content	Adopted Measure
Motor is not rotating	If wire layout is abnormal or power supply cables are connected with input terminal (R,S,T)	Please make sure right wiring, Power on Cut off power and power on again
	If bypass contactor is working well, 01 and 02 terminals has signal.	Check the connection of bypass contactor Check connection of bypass contactor coil
	If keyboard has abnormal display	Please read P17 protection action list
	if motor is locked(if load is too heavy)	Please release motor locking(reduce load)

Keyboard can't be used to start	If keyboard displays emergency stop or terminal is open or code FB setting is normal	No: if existing phase loss of power supply, check incoming power supply Yes: if 10 and 11, 12 are open. Check external terminal wiring and set code FB correctly.
External control can't be used to start	If code FB is set as external control	Terminal 14 and 11, 12 are open, check external terminal wiring, set code FB correctly and make sure FB is external control.
Motor is rotating and speed is not changing	If load is too heavy	please reduce load Increase initial voltage or starting current
starting time is over long	Load is too heavy Code is not setting well If motor type is normal	Reduce load Set F0(initial voltage), F5(start ing limitation current)F1(soft starting time) Please check type instruction manual and nameplate
Starting time is overshot	light load Starting time is too short	When load is light, the starting time is less than setting value, it will be normal when starting finishing. Set code F1 starting time(current mode is invalid)
Suddenly stop during running	Check external input terminal	Check if terminal 11 and 14 are loosen If connecting with external protector, please check if NC contact is active. Check if the external stop button wiring is loosen

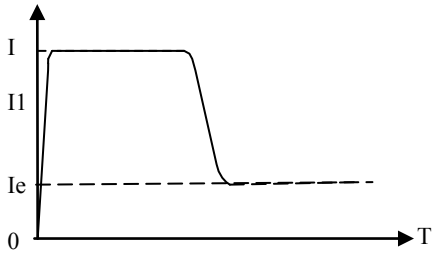
12 Starting mode

12-1 Current limitation mode

① Code F9 =0 is current limitation starting mode. Picture 12-1-1 shows the motor current change curve for current limitation starting mode.I1 is the setting starting current limitation value. When the motor starts, output voltage will increase fatly until the motor current reaches the setting current limitation value and keep the current value not more than setting value. Then following the gradual rising of the voltage, motor will accelerate gradually. When the motor reaches the rated speed, bypass contactor will close. Output current will go down to rated current or below fatly, starting process will be finished.

② when the load is light or setting current limitation value is to high, so it is normal that maximum starting current will possibly not reach the setting value. Current limit mode is generally used for the application which requires the strict limit for starting current.

12-1-1

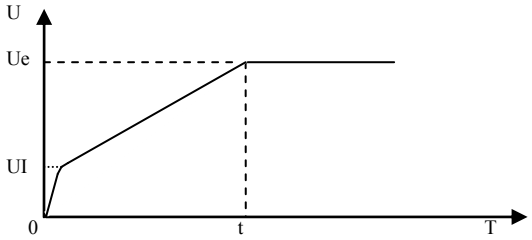


12-2 Voltage ramp starting

① Code F9=1 (voltage) is voltage ramp mode. Picture 12-2-1 has shown the output voltage wave of voltage ramp starting. Ui is the initial voltage of starting, when the motor is starting, the motor current will not exceed 400% of rated current. The output voltage of soft starter will rise up to UI quickly. Then the output voltage will gradually rise up according to setting parameters of starting. Motor will smoothly accelerate along with the rising of voltage. When voltage reaches the rated value Ue, motor will achieve rated speed, then the bypass contactor will close and the starting process will be finished.

② Starting time: t is the measured controlled parameter under standard experimental condition according to standard load. QDS series soft starter will use this parameter as benchmark, then by controlling the output voltage makes the motor accelerate smoothly so that to finish the starting proccess.Not controlling the time t by mechanical method no matter if acceleration of motor has been smooth. For this reason, when the load is light, the starting time will be less than setting time. It is normal as long as the starting is finished successfully. Generally, voltage ramp starting mode will be suitable for the application which requires non-strict starting current but high smooth starting.

12-2-1

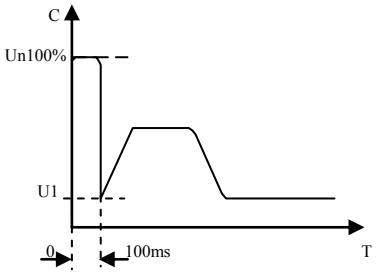


12-3 Kick-off mode

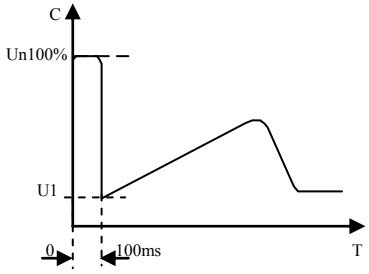
① Code F9=2 (kick-off+voltage ramp) or =3 (kick-off+current limitation) starting mode, 12-3-1 and 12-3-2 have shown output waveform of kick-off mode. For some heavy load application, the motor can't start because of mechanical static friction, this mode will be available. At the beginning of starting, applying high constant voltage on motor and lasting for a while in order to overcome static friction of motor load to make motor run. Then motor will start according to current limitation or voltage ramp.

② before using this mode, firstly choose non kick-off mode to start motor, if the motor can't rotate because of high static friction, this mode will be chosen. Or else this mode should be avoided to use in order to reduce the unnecessary impact current.

12-3-1



12-3-2

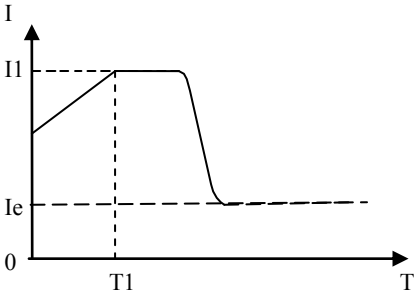


12-4 Current ramp starting mode

① Code F9=4(current ramp mode)is the starting mode, 12-4-1 is the output current waveform of current ramp starting mode.I1 is the starting time set in F1.

② Current ramp stating mode will make motor strong acceleration ability. It is available for two poles motor, this mode will short starting time for some range.

12-4-1



12-5 Dual closed-loop starting

① Code F9=5(dual closed-loop) is dual closed-loop starting mode. Dual closed-loop mode of Voltage and current will adopt dual closed-loop control of voltage ramp and current limitation. This mode is available for requiring both smooth starting and strict current limitation; it adopts the prediction algorithm to estimate the motor work state.

② The output voltage waveform of this starting mode will vary according to different state of motor and load.

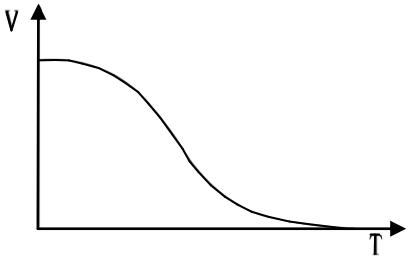
12-6 Soft stop

QDS series soft starter has two stop modes, namely soft stop and free stop.

① T is the soft stop time set in F2. For this mode, the power of motor will switch from bypass contactor to SCR of soft starter. The output voltage of soft starter will gradually decrease from full voltage to make motor speed reduce smoothly so as to avoid the mechanical fluctuation until the motor stops running. The cut-off voltage of soft stop is equal to the initial voltage of soft starting.

② Code F2=0 is soft stop mode. 12-6-1 is the output current waveform of soft stop mode; Soft stop can reduce or eliminate water hammer of pump and reduce the impact of big current for soft stop. This soft stop current limitation value is the percent calculated base on starting current limitation.

12-6-1



12-7 Free stop

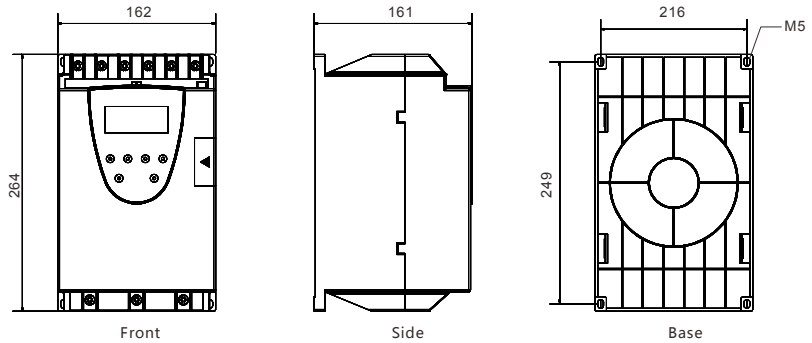
①Code F9=0(free stop) is free stop mode. For this stop mode, soft starter will accept the stop command and cut off bypass contactor control signal and prohibit the SCR output. The motor will gradually stop depending on load inertia. if one soft starter drives N motors, set the code as this mode and avoid phase loss fault during the output switching.

②Generally, if no soft stop is needed, the free stop mode should be chosen to prolong the life span of soft starter. Soft stop mode can prohibit the instant output completely which will avoid the instant big current impact of special application

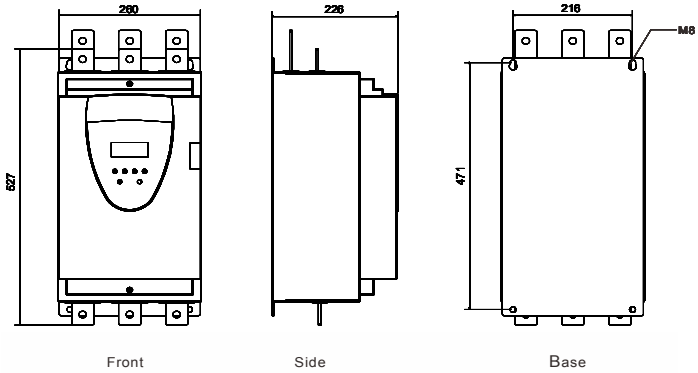
QDS series soft starter has six different starting modes, which will be available for variable complicated motor and load. User can select soft starter according to different application.

13 Overall dimensions（mm）

13-1 QDS005 to QDS055



13-2 QDS075 至 QDS320



Remarks: Outline dimensions will probably change in future. Please check the real equipment.

14 Application range

14-1 Application load types

QDS soft starter could meet the most heavy load applications. Please see below list for your reference.

Load type	Ramp start time(s)	Ramp stop time (s)	Initial voltage (%)	Voltage start(Maxim current limit value)	Current limit start
Centrifugal pump	16	20	40	4	2.5
Ball mill	20	6	60	4	3.5
Fan	26	4	30	4	3.5
Light motor	16	2	30	4	3
Piston compressor	16	4	40	4	3
Lift machinery	6	10	60	4	3.5
Crusher	16	2	50	4	3
Screw compressor	16	10	50	4	3.5
Screw conveyor	16	2	40	4	3
Heat pump	20	10	40	4	2
Screw transportation	20	10	40	4	2.5
heat pump	16	20	40	4	3

15 RS485 Communication

QDS series soft starter will connect with PC and PLC through interior RS485 standard communication module to carry out serial communication.

The master can control the soft starter to run and stop, and monitor the running state of soft starter and modify other function data. The detailed information of this communication should refer to RS-485 operation manual.

The RS-485 communication of soft starter can be used to communicate with computer for remote operation. Input run command and manage running state. Multiple soft starter function code data will write in for one time so as to realize the simple operation of the function code input.

Main functions:
1, run and stop command input
2, running state monitoring
3, real-time tracing (running information shown in table)
4, function code writes in and read out for one time, save into document.

The communication software needs to be consulted with our company.

15-1 MODBUS Communication protocol

15-1-1 Relative Modbus RTU communication protocol overview.

Modbus is series asynchronous communication protocol. The physic port is RS485. Modbus is designed by modicum for PLC, which has the property of PLC. In modbus control net, QDS can be treated as a PLC to be read and written. Start and stop command, state information (current, fault) and function parameters will be reflected to holding registers (4XXX).using PLC master to read and write to soft starter.

（1）Electric port

RS485 half-duplex

Communication parameter: bade rate: 9600; 8 bits data bit; no calibration; 1 bit stop bit

（2）communication data format

data format：

address code	function code	date zone	CRC calibrion
1 byte	1 byte	N bytes	2 bytes

15-1-2 related setting of soft starter

（1）Holding address

Holding register address	Operation code	Holding register function instruction
40001	06	control word
40002	03	state word
40003	03	*10 average current
40004	03	fault code
40256-40274	03&06	function code of soft starter

- The registers unlisted are illegal ,can't read and write, or else the slave will report to master a exception state code.

- All the data addresses are referring to 4000, namely coil relay 40001 address is 0001, address of 402567 is 0100(hex)

（2）Available code

Soft starter is just supporting following code, if using other code will offer exception case code 1

code	03	06
Function description	Read register	Write single register

Code 03 is just used for single word read.

（3）Register instruction

40001 command register

bit	value	description
0	1	soft starter starting
	0	holding state
1	1	soft starter stop
	0	holding state
2	0-1	make soft starter reset
3-15	0	no use

For example: slave address of soft starter is 02, master sends out 02 06 00 01 00 01, if the command is activated normally, slave will return code 02 06 00 01 00 01. The state register should be checked to make sure if the soft starter can start normally. If existing fault, sending 02 06 00 01 00 04 to reset fault.

Register address 40002state register

State register will reflect the state of soft starter, which is indicated by a word.

Bit	value	description
0	1	starting state
	0	stop state
1	1	sunning state
	0	stop state
2	1	soft stop state
	0	stop state
3	1	fault state
	0	normal state
4-15		No use

For example: read state register code 02 03 00 02 00 01

If soft starter is starting, the return code 02 03 02 00 01,

If soft starter existing fault, return code 02 03 02 00 08, and read fault type according to 4.

40003 current average (hex)

This value reflects three phase actual current average of motor *10(including a fractional part)

For example: read current

Send: 02 03 00 02 00 0

If current is 235A, return 02 03 02 09 2E(return value/10 is the actual current)

40004 fault code (hex)

When state register 40003 bit 3 is 1, which means that soft starter is in fault state. Fault code is in accordance with 6.1.

For example:

Send: 02 03 00 04 00 01

If return 02 03 02 00 04.which means present input phase loss (fault code 04)

Soft starter function parameter register40XXX

40256-40274 is function registers, corresponding to 0X0100-0X0112, high order byte address is 01, low order byte address is 0X00-0X12. Corresponding to F0-FL, they are in accordance with code table 4.2.for example address 0X109 is corresponding to code F9(starting mode), can read and write to these codes. Following will offer example respectively:

Example 1 read function code F5 () limitation current value)

Send: 02 03 01 05 00 01

Return function code of read F5: 02 03 02 01 5E means limitation current value is 350%.

Example 2 read function code FA (protection class)

Send: 02 03 01 0A 00 01

Return function code of read FA: 02 03 02 00 03 means that the protection class read is 3

Example 3: Change function code 05 of the soft starter (start current) to be 250%

The master will send the code: 02 06 01 05 00 FA and soft starter return the code : 02 06 01 05 00 FA. If the return value is 02 86 03, then it could not input any data and probably the soft starter is under running.

15-1-3 Abnormal response

code	name	instruction
01	illegal function	If code can't execute, soft state will not support
02	illegal data address	The data address received can't execute. The address overflows
03	illegal data value	The data received can't execute 1 Parameters surpasses the limitation 2 Parameters can't modify 3 Parameters can't modify when soft starter is running

（1）illegal function code 01

Master inquiry message format:

Slave address	Function code	High order byte of initial address	Lower byte of initial address	High order of register number	Low order of register number	CRC check
0x01	0x08	0x00	0x80	0x00	0x00	

This function code 0x08 is never used in this protocol, so slave will response:

slave address	function code	abnormal code	CRC check
0x01	0x88	0x01	

（2）illegal function code 02

Master inquiry message format:

Slave address	Function code	High order byte of initial address	Lower byte of initial address	High order of register number	Low order of register number	CRC check
0x01	0x04	0x01	0x80	0x00	0x07	

04 function code register address error, so slave will response:

slave address	function code	abnormal code	CRC check
0x01	0x84	0x02	

（3）illegal function code 03

Master inquiry message format:

Slave address	Function code	High order byte of initial address	Lower byte of initial address	High order of register number	Low order of register number	CRC check
0x01	0x04	0x00	0x80	0x01	0x80	

04 function code register number error, so slave will response:

slave address	function code	abnormal code	CRC check
0x01	0x84	0x03	

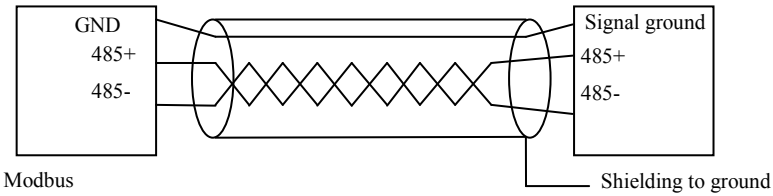
15-1-4 use attention

(1) The communication address, communication bade rate, check mode should keep same with controller.

(2) If can't receive response data, please check parameter setting above, and check if 485 terminal connection is correct, if CRC calcification is correct.

(3) For multiple communications, please add a 120Ω resistor

(4) If connect with other Modbus device, please connect as following



16 Spare parts list

16-1 QDS circuit accessory equipment and cable size:

(380V)

Motor parameter		Soft starter	Circuit breaker	Electrom agnetic contactor	Cable/Copper bar
Power（kW）	Current（A）	Model specification	Model specification	Model specification(By-pass)	Copper core gauge（mm）
5.5	11	QDS005	CM1-63/16	CJ20-16	2.5
7.5	15	QDS007	CM1-63/20	CJ20-16	4
11	21	QDS011	CM1-63/32	CJ20-25	6
15	18	QDS015	CM1-63/40	CJ20-40	10
18.5	34	QDS018	CM1-63/50	CJ20-40	10
22	42	QDS025	CM1-63/63	CJ20-63	16
30	54	QDS030	CM1-100/80	CJ20-63	25
37	68	QDS037	CM1-100/100	CJ20-100	35
45	80	QDS045	CM1-160/120	CJ20-100	35
55	98	QDS055	CM1-160/160	CJ20-160	35
75	128	QDS075	CM1-225/180	CJ20-160	50
90	160	QDS090	CM1-225/225	CJ20-250	30x3
115	190	QDS115	CM1-225/315	CJ20-250	30x3
132	236	QDS132	CM1-400/315	CJ20-400	30x3
160	290	QDS160	CM1-400/350	CJ20-400	30x5
200	367	QDS200	CM1-400/500	CJ20-400	30x5
250	430	QDS250	CM1-630/630	CJ20-630	40x5
280	470	QDS280	CM1-630/630	CJ20-630	40x5
320	547	QDS320	CM1-630/700	CJ20-630	40x5
400	725	QDS400	CM1-630/800	CJ20-1000	40x6

17 Appendix

Warranty and after-sales services

Thanks very much for choosing QDS soft starter manufactured by Shanghai QIROD Electric Science & Technology Co., Ltd. The products are made under mature quality management system. For your easy operation, we make our promise to warranty and after-sales services in the below.

1 Warranty

Warranty is 12months after purchase or 24months since the date on the nameplate. Anyway, we will provide the repair with possible charge due to below reasons which caused the fault.

1) Wrong operation
2) Mover standard operation range
3) Broken down based on falling down during the transportation
4) Earth quake, fire, wind, thunder, abnormal voltage and other natural disasters.

2 After-sales service

1) When it is under unstable status, please do the regular inspection. And then read the operation manual and re-check again.

2) When the fault happens, please contact the distributor or contact the after-sales office listed in the operation manual.

3) Within the warranty, the repair will be free due to our quality issue. But the user has to correctly input all kinds of content in the warranty letter. Or we will charge the necessary cost.

4) Over the warranty service, we will charge some cost if we can successful repair the equipment.

3、Service promise

1) QDS series soft starter below 75kw (including) could be replaced without human reason under one-year warranty. And the soft starter above 75kw will be promised to free repair within one-year warranty without human reason.

2) We promise to offer technical support: we would like to send our technician to the site to carry out commission & installation and offer free training to related technical employee. (For the international customers, they have to afford the flight tickets, local transportation cost and related accommodation)

3) We will reply to our customer within 24hours based on the kind request from our customers.

Warranty Letter of QIROD

Customer name		Contact		Tel	
Address				Fax	
Model		Ex-factory series no.			
Supplier Name		Purchase date			
Address		Fault date			

Fault status

Application			Motor	____KW___ Pole Model_____	
When	Connective running/ acceleration/ deceleration/ power on/ others				
Time display	Alarm display( ) keypad display( ) voltage display(yes no)				
Running after reset	Possible/ impossible/ reset method/ keypad / terminal/ power /supply others				
Control terminal usage	01,02 03,04,05 06,07,08 09,10 11 12 13 14,15 16,17,18 19				
Work time		Frequency	/	Installation room	
Power off	Y N	Abnormal situation around the machine	Y N	Failure record	Y/N

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